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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/994,279	11/26/2001	Tony P. Chiang	PA1688US	8825

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EXAMINER

NHU, DAVID

ART UNIT PAPER NUMBER

2818

DATE MAILED: 06/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/994,279

Applicant(s)

CHIANG ET AL.

Examiner

David Nhu

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(e). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 June 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 22 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-13 is/are allowed.
- 6) ☒ Claim(s) 14-16, 18, 20 and 21 is/are rejected.
- 7) ☒ Claim(s) 17, 19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3, 4. 6) ☐ Other: _____

DETAILED ACTIONS

Claims 1-21 are present for examination.

Election/Restrictions

1. *Applicant's election of Group I (Claims 1-21) in page No.6 is acknowledge.*

Claims 1-21 are present for examination. Accordingly, claim 22 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Specifications

2. *There is no description of layer 190 in the specification. See figure 1.*

There is no description of layer 325 in the Specification. See figure 3C.

There are no descriptions of layers 420, 430, 440 in the specification. See figure 4A.

There are no descriptions of layers 460, 465, 470, 485 in the specification. See figure 4B.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 14-16, 18, 20-21 are rejected under U.S.C 103(a) as being unpatentable over Background of Invention (BOI) in view of Sherman et al (5,916,365).

Regarding claim 14, BOI, figures 3B, 4B, pages 1-6, disclose a method for integrated, in-situ modification of a substrate and subsequent atomic layer deposition of a thin film onto said substrate in an evacuated chamber beginning with initial modification steps.

[BOI fails to teach the step of introducing at least one first radical generating feed gas into said chamber; generating a plasma from said radical generating feed gas to form radicals; exposing said substrate to said radicals; reacting said substrate with said radicals to remove any contaminants from said substrate and producing a modified substrate; and following said initial modification steps, performing an atomic layer deposition of a thin film onto said modified substrate in said chamber including: introducing a first reactant gas into said chamber; adsorbing at least one monolayer of said first reactant gas onto said modified substrate; evacuating any excess said first reactant gas from said chamber introducing at least one additional radical generating feed gas into said chamber, said additional radical generating feed gas may be the same feed gas as said first radical generating feed gas; generating a second plasma from said additional radical generating feed gas to form additional radicals; exposing said modified substrate to said additional radicals; and reacting said adsorbed monolayer of said first reactant gas with said additional radicals to deposit said thin film.)

[However, Sherman, figures 1-3, and related on col. 1-10, (col. 5, lines 8-22), teach the step of introducing at least one first radical 28 generating feed gas into said chamber 2; [generating a plasma] from said radical generating feed gas to form radicals; exposing said substrate 12 to said radicals; reacting said substrate with said radicals to remove any contaminants (see col. 7, lines 13-26) from said substrate and producing a modified substrate; and following said initial modification steps, performing an atomic layer deposition of a thin film onto said modified substrate in said chamber including: introducing a first reactant gas into said chamber; adsorbing at least one monolayer of said first reactant gas onto said modified substrate; evacuating any excess said first reactant gas from said chamber introducing at

least one additional radical 29 generating feed gas into said chamber, said additional radical generating feed gas may be the same feed gas as said first radical generating feed gas; generating a second plasma 42 from said additional radical generating feed gas to form additional radicals; exposing said modified substrate to said additional radicals; and reacting said adsorbed monolayer (see col. 7, lines 45-52) of said first reactant gas with said additional radicals to deposit said thin film (see col. 9, lines 50-67).

Regarding claim 15, (BOI, pages 4, 5) teaches the initial modification steps are in-situ preclean steps.

Regarding claim 16, (BOI, page 5) teaches the initial modification steps are surface treatment steps

Regarding claim 18, (Sherman, col. 7, lines 13-26) teaches contaminants comprise native oxides, metal oxides, particulate contamination, and carbon containing impurities.

Regarding claims 20, 21 (Sherman, col. 7, 8, Examples 1-7) teaches a barrier material film and a copper seed layer are deposited following said initial modification steps. Also see BOI, pages 4-5.

It would have been obvious to one having ordinary skill in the art at the time of the present invention to apply the teachings of Sherman into the method of BOI as both are related to the same subject matter of depositing a thin film onto a substrate in an evacuated chamber with an in-situ preclean process and a sequential CVD process.

Allowable Subject Matter

5. *Claims 1-13 are allowed.*

6. Claims 17, 19 are **objected** to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Claims 1-13, 17, 19 include allowable subject matter since the prior made of record and considered pertinent to the applicant's disclosure does not teach or suggest the claimed limitations. Because BOI and Sherman (5,916,365) taken individually or in combination, do not teach modulating ions; reacting the substrate with modulated ions to remove any contaminants from the substrate and producing a modified substrate; modulating additional ions; reacting adsorbed monolayer of said first reactant gas with modulated additional ions to deposit a thin film; the atomic layer deposition steps additionally include introducing at least one ion generating feed gas into said chamber and generating a plasma from said ion generating feed gas to form ions; repeating for each film deposition layer.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Tharkur'833, Moslehi'434, Maydan'601 are cited as of interest.
8. A shortened statutory period for response to this action is set to expired 3 (three) months from the date of this letter. Failure to respond within the period for response will cause the application to become abandoned (see 710.02 (b)).

Application/Control Number: 09/994,279
Art Unit: 2818

Page 6

9. Any inquiry concerning this communication on earlier communications from the examiner should be directed to David Nhu, (703) 306- 5796. The examiner can normally be reached on Monday-Friday from 7:30 AM to 5:00 PM. The examiner's supervisor, David Nelms can be reached on (703) 308-4910.

The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7724.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956

David Nhu 

June 25, 2002

